

## PATENT SPECIFICATION

DRAWINGS ATTACHED

L107.024



Inventor: WILLIAM HENRY GIBSON

Date of filing Complete Specification: 4 Nov., 1966.

Application Date: 4 Nov., 1965.

No. 46882/65.

Complete Specification Published: 20 March, 1968.

© Crown Copyright 1968.

Index at acceptance:—F1 TB2B2

Int. Cl.:—F 01 d 5/20

## COMPLETE SPECIFICATION

## Improvements in and relating to Blades for Turbo-Machines

We, C. A. PARSONS & COMPANY LIMITED, of Heaton Works, Newcastle upon Tyne, 6, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to blades for turbo-machines.

In the case of turbo-machines employing unshrouded blading, damage to the tips of the blades sometimes occurs. A known method of dealing with this problem is to provide the blades with tips of reduced cross-sectional area so as to limit the amount of damage arising from accidental rubbing of the blades on the casing of the machine or on the rotor in the case of stator blades.

The effect of the rubbing action is to wear away the portion of reduced cross-section and, whilst this reduces damage to the blades, it has the effect of increasing the clearances at the blade tips and hence reducing the performance of the machine.

Eventually it is necessary to replace the worn blades to restore the desired clearances and this is a costly and time consuming operation.

In accordance with the present invention a blade of a turbo-machine is fitted at its free end with a sleeve having an outer profile similar to that of the blade, which sleeve fits over the end portion of the blade, is joined to and projects beyond the end of the blade for instance as shown in the drawings referred to hereinbelow.

The sleeve may be in the form of a hollow blade section having an inner profile the same as or similar to that of the blade over which it is fitted or only its outer surface may have the profile of the blade over which it is fitted with the inner profile of the sleeve shaped so as to fit over a projection on the end of the blade.

Referring to the drawings accompanying the

Provisional Specification, Figure 1 is a plan view of a conventional blade having a tip portion of reduced cross-section.

Figure 2 is a section on line AA of Figure 1 over part of the length of the blade and also shows parts of an adjacent casing wall.

Figure 3 is a plan view of a blade in accordance with one form of the present invention.

Figure 4 is a section on line BB of Figure 3 over part of the length of the blade and also shows part of an adjacent casing wall.

The blade 1 of Figures 1 and 2 has a tip portion 1a of reduced cross-sectional area and this portion is worn away by any rubbing action between the blade and adjacent casing wall 2 thus gradually increasing the clearance 3 between the blade tip and the wall 2.

In the blade illustrated in Figures 3 and 4 the free end of the blade, that is the end remote from the blade root, is fitted with a sleeve 4 which, in the form shown, is a hollow blade section having an inner profile the same as or similar to that of the blade 1.

Whilst the use of a sleeve of the form illustrated enlarges the blade profile at the end of the blade, any loss of performance resulting from the use of an enlarged profile is offset by the fact that the presence of two walls of the sleeve adjacent the wall of the casing or the surface of the rotor, increases the resistance to fluid flow through the clearance space compared with the conventional construction shown in Figures 1 and 2.

The height and thickness of the sleeve will vary according to circumstances but in a typical example, for a steam turbine, the sleeve may have a thickness of about 20 thousandths of an inch and the height of the sleeve be of the order of 0.25" with a length of about 1/16" projecting beyond the end of the blade.

The material of the sleeve may be the same as that used for the blade.

In the form shown in Figure 4, the sleeve is shown fitted to a blade of the form shown in Figures 1 and 2, part of the tip 1a of which

has been worn away. Thus the sleeve can be used to repair conventional blades when the blade tips have worn to an extent such that the clearances on the ends of the blades are too large to be acceptable. By adding a sleeve of the form shown replacement of the blade is unnecessary.

Whilst the sleeve may be used to repair conventional blades it may also be added when the blade is first made. In such a case there is no necessity to provide the portion of reduced cross-sectional area at the end of the blade.

The invention may be applied to steam turbines, compressors, fans and other turbo-machines where the problem of rubbing between the blade tips and adjacent surfaces may be present.

WHAT WE CLAIM IS:—

1. A blade for a turbo-machine which blade is fitted at its free end with a sleeve having an outer profile similar to that of the blade

which sleeve fits over the end portion of the blade, is joined to and projects beyond the end of the blade.

2. A blade for a turbo-machine as claimed in claim 1 in which the sleeve is in the form of a hollow blade section having an inner profile the same as or similar to that of the blade over which it is fitted.

3. A blade for a turbo-machine as claimed in claim 1 in which the sleeve on its outer surface has the profile of the blade over which it is fitted whilst the inner surface of the sleeve is shaped so as to fit over a projection on the end of the blade.

4. A blade for a turbo-machine substantially as herein-above described with reference to Figures 3 and 4 of the drawings accompanying the Provisional Specification.

MARKS & CLERK,  
Chartered Patent Agents,  
Agents for the Applicants.

